2.1 WATER RIGHTS

As outlined in the *Comprehensive Water System Plan* (CH2M Hill, 1995), the City of Port Angeles maintains water rights on the Elwha River and Morse Creek. The water rights on the Elwha River are summarized below.

The City obtained an appropriation of 150 cfs (97 mgd) from the Elwha River on August 12, 1927. The 1927 permit, Permit Number 1397, was for manufacturing purposes. The water right was verified with a certificate of water right on April 15, 1940. In 1974, through a change of use permit, 50 cfs of the 150 cfs was to be used for fish rearing by the WDFW.

The City's current water right includes 100 cfs (65 mgd) for manufacturing or industrial water supply and 50 cfs (32 mgd) for fish rearing.

In 1975, the City obtained Permit No. G2-21950 for the City's municipal supply totaling 50 cfs (32.4 mgd). The original permit requires that the water permit be certified by July 1, 2000, and an extension was granted to allow the permit to be valid through July 1, 2020. The annual appropriation for this water right is 20,600 acre-ft/yr (28.4 cfs or 18.4 mgd). According to the *Comprehensive Water System Plan* (CH2M Hill, 1995), the City's projected future water usage, maximum day demand (MDD) is 9.37 mgd in 1999, 9.63 mgd in 2003 and 10.23 mgd in 2012; therefore the City of Port Angeles has adequate permitting in-place for its municipal supply to meet future demands.

2.2 PRESENT WATER QUALITY

The Elwha River, its tributaries, Lake Mills, and Lake Aldwell are classified by the Washington Department of Ecology as Class AA waters, signifying "extraordinary" quality. Overall, the Elwha river has relatively low concentrations of dissolved and suspended sediment loads, nutrients, and organics. Suspended sediment concentrations and turbidity of the lower river are currently related to the reservoir trapping efficiency, flood flows, logging, agricultural practices, and bank erosion.

The water quality of the Elwha River is excellent with the concentrations of many chemicals below detection limits and all detections are less than the maximums allowed by the EPA and Washington State Drinking Water regulations. The quality of the Elwha River and the groundwater from the alluvium aquifer are very similar because of their hydraulic connection. The watershed feeding the Elwha River is under National Park status in the upper reaches. There are no landfills or industrial discharges into the river. Because of the small number of farm operations and limited development, non-point sources of pollution from agricultural and urban run-off have a very minor influence on the water quality.

The *Water Quality Analysis and Mitigation Measures Report* (BOR, March 1997) reports water quality data from the Elwha River measured from a United States Geological Survey (USGS) gauging station at McDonald Bridge at river mile 8.6. The data reported was collected from 1974 to 1986. The concentration ranges of water quality criteria most likely to be impacted from dam removal are summarized in Table 2.1.

Table 2.1

ELWHA RIVER WATER QUALITY SUMMARY

Parameter and Unit	Concentration
Dissolved Oxygen	95-110 Percent Saturation
Total Suspended Solids (TSS)	1 to 1,500 mg/L 1.3 to 531 tons/day
Turbidity	1 to 800 NTU
Total Iron	0.02 – 2.3 mg/L
Copper	0.02 – 0.43 mg/L
Total Manganese	0.004 - 0.21 mg/L
Peak Temperature	66 ^{0}F
pH	6.7 – 10
Total Alkalinity	21 – 44 mg/L
Total Organic Carbon	0 – 10 mg/L

1 Source- Water Quality Analysis and Mitigation Measures Report. BOR, March 1997.

As stated earlier, the City of Port Angeles receives water for municipal supply from a Ranney collector at Elwha river mile 2.8. The Ranney collector draws water from the alluvium of the Elwha River at a depth of approximately 60 feet. The water in the alluvium is hydraulically connected to the surface water in the river. The alluvium does an excellent job of filtering the surface water and provides water of excellent quality. Chemical analysis of the water from the Ranney collector is presented in Appendix A. All chemical analyses indicated the chemical concentrations of water in the collector were below all state and federal primary and secondary drinking water standards. An analysis of copper taken from the distribution system in 2001 showed a concentration of 1.6 mg/L while the copper concentration at the source was between 0.02 and 0.43 mg/L (Appendix G1, Water Quality Analysis and Mitigation Measures, BOR, March 1997). The state standard for copper in the distribution system is 1.3 mg/L, suggesting a potential issue with corrosion within the Port Angeles water distribution system. The possible copper sources in the water distribution system are corrosion of brass and copper pipes and related fixtures.

Figure 2.1 shows the removal efficiency of the river alluvium by comparing turbidity in the surface water verses turbidity in the Ranney collector according to City operating records. The data shows an average turbidity removal efficiency of 94%.

In addition, water quality data collected at Daishowa and the former Rayonier mill are presented in Appendices B and C, respectively. The data collected by Daishowa shows turbidity data collected three times daily before and after treatment for the years 1983 through 1993, and data collected in 1999. Table 2.2 shows the monthly maximum and average turbidity readings recorded at Daishowa for the data reviewed.

Figure 2.1 Turbidity Data in Elwha River Vs. Existing Municipal Ranney Collector

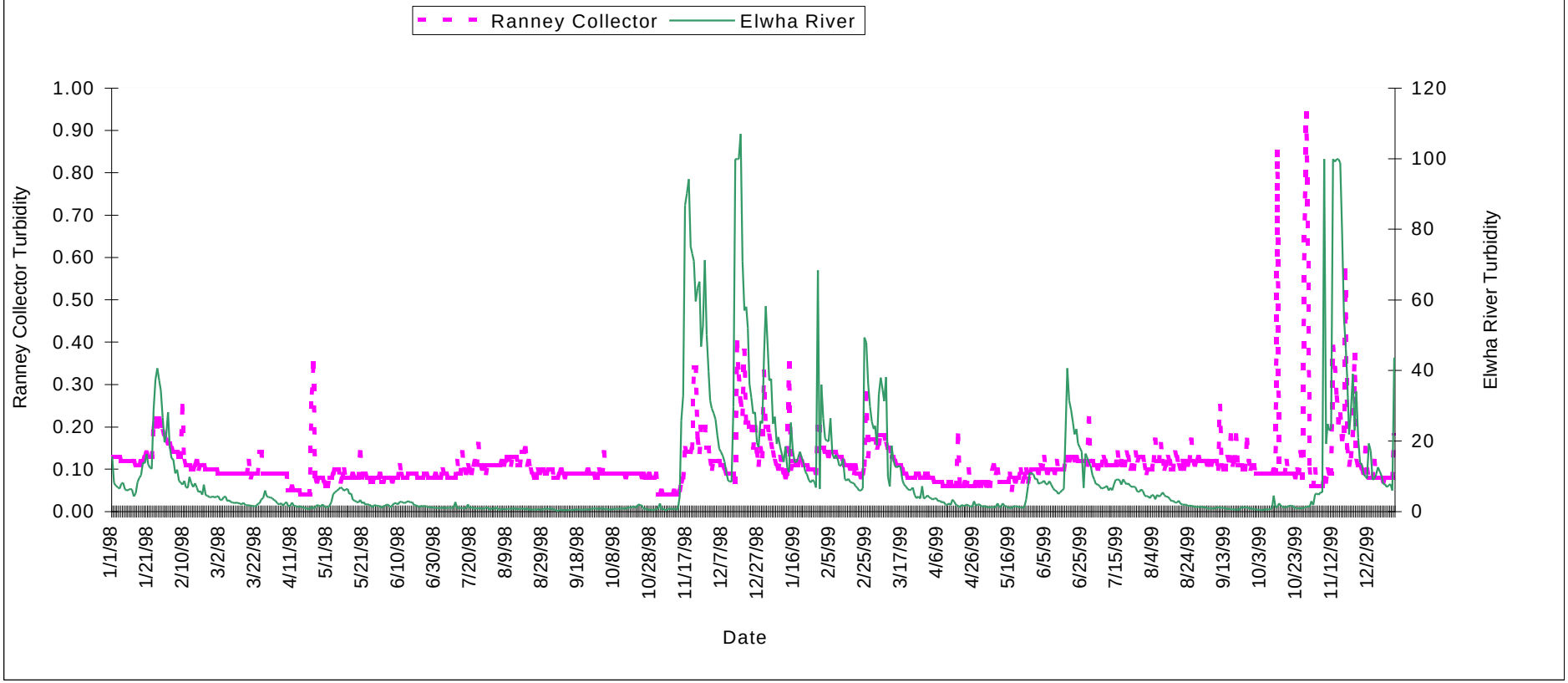

Table 2.2

MONTHLY MAXIMUM AND AVERAGE TURBIDITY READINGS AT DAISHOWA FOR YEAR 1983 – 1993 and 1999

Month	Maximum Turbidity Reading (NTU)	Average Turbidity Reading (NTU)
January	207	15
February	511	15
March	55	6
April	13	3
May	20	3
June	26	4
July	12	2
August	20	1
September	31	2
October	72	4
November	563	29
December	398	20

The data collected by Rayonier shows TSS concentrations measured daily from 1988 to 1991. Table 2.3 shows the monthly maximum and average turbidity readings recorded at Rayonier for the data reviewed.

Table 2.3

MONTHLY MAXIMUM AND AVERAGE TSS READINGS AT RAYONIER FROM 1988 - 1991

Month	Maximum TSS Reading (mg/L)	Average TSS Reading (mg/L)
January	41	9
February	14	2
March	15	3
April	12	3
May	12	2
June	13	3
July	41	6
August	45	6
September	55	5
October	16	4
November	846	46
December	159	34

2.3 ANTICIPATED WATER QUALITY DURING AND AFTER DAM REMOVAL

The removal of the Glines Canyon Dam and the Elwha Dam will allow sediment loads trapped behind the dams to move downstream to the ocean. In the short-term (a period of up to 5 years during and after removal of the dams), the water quality parameters that could be adversely affected include: suspended and dissolved solids, total organic carbon, turbidity, dissolved oxygen, iron, manganese, and temperature. Of these water quality parameters, the anticipated high concentrations of suspended solids present the greatest treatment challenge.

Suspended sediment concentrations will generally be much higher than currently experienced, and there will be intermittent periods of 1 to 3 days when large amounts of suspended sediment will be present in the Elwha River during dam demolition. High sediment loads may also occur after the dams are removed due to flood events until the sediments behind the dams are eroded away. The sediment transport model (BOR, October 1996) predict that concentrations of suspended sediments in the river could exceed 50,000 parts-per-million (5% solids) during individual high turbidity events.

Over the long-term, natural processes will be restored and water quality will return to natural conditions. The watershed in the reservoir area will have been returned to natural conditions, and the water quality associated with those natural conditions will be observed, whereas currently, the reservoirs behind the dam act as a buffering zone against substantial changes to water quality. Natural events such as landslides and forest fires may increase short term sediment loads in the river although they will have much less of an effect than the dam demolition.

A summary of current water quality conditions and anticipated water quality conditions within the Elwha River both in the short and long-term are presented in Table 2.4.

Table 2.4

ANTICIPATED IMPACTS TO WATER QUALITY

Water Quality Parameter (Units)	Current Conditions	Anticipated Short-Term Conditions	Anticipated Long-Term Conditions
Dissolved Oxygen (% saturation)	95-110	90-100	95-110
Total Suspended Solids (mg/L)	15[1]	15,000-51,000	69[1]
Turbidity (NTU)	1-800	2,000-25,000	1-1,000
Total Iron (µg/L)	20-2,300	30,000-50,000	10-5,000
Total Manganese (µg/L)	4-210	500-10,000	10-700
Peak Temperature (°F)	66	59-66	59-63
pH	6.7-10	5-9	6.5-8.5
Total Organic Carbon (mg/L)	0-10	100-1,000	10-200

Notes:
1. Represents average conditions.
2. All information from *Water Quality Analysis and Mitigation Measures Report*, Bureau of Reclamation, March 1997, Elwha Technical Series PN-95-8